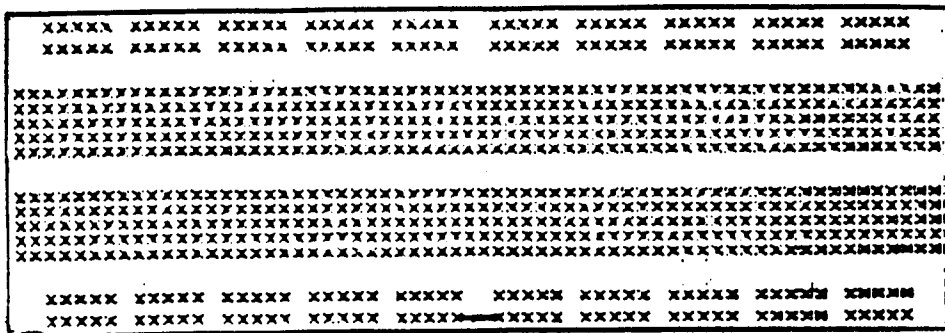
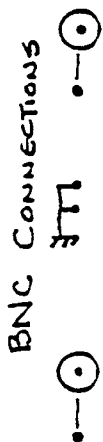
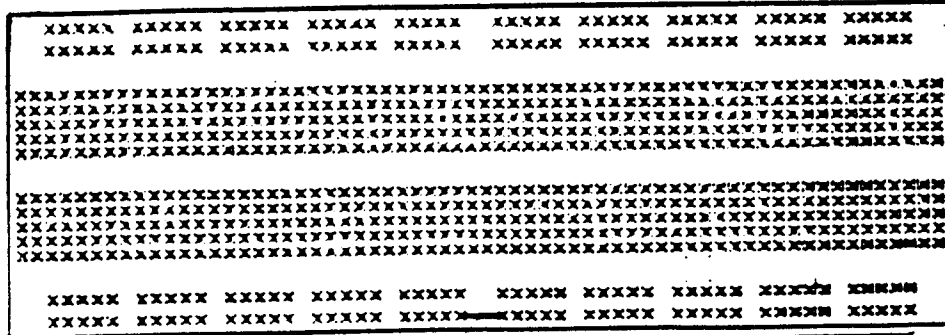


Physics 623  
**OPERATION MANUAL FOR BREADBOARD**  
 September 6, 1994

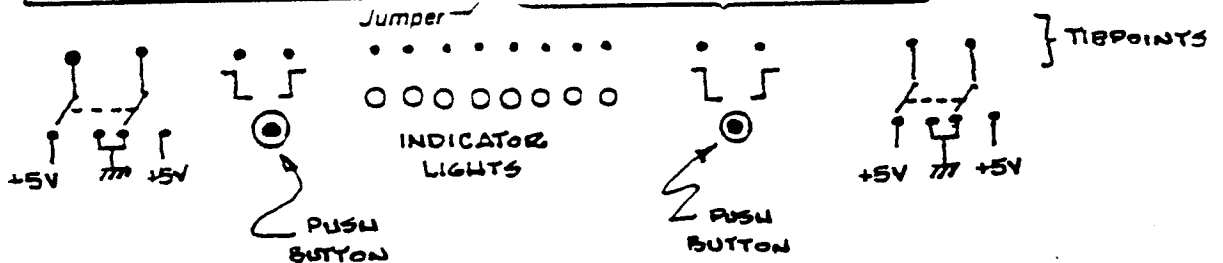
The breadboard supplied for use in Physics 623 is our version of a product commercially available from a number of firms. It is useful in prototyping both analog and digital circuits.



LONGITUDINAL  
BUS (5) ...



TRANSVERSE  
BUS (25)



# Notes about using the Breadboards

1. The front face of the breadboard is diagrammed in the figure. The centerpiece of the device is the *tiepoint block*. The tiepoint block provides a method of reliably connecting component parts together without soldering them. Jumper wires are used to interconnect the components which in turn are mounted directly on the block. Each terminal position consists of five (5) connected points.
2. Fixed voltages are available from the sixteen (16) buses each consisting of 25 electrically connected tie points. These buses may be patched around or jumpered together in any combination to provide unique or common functions such as voltage and ground distribution, reset lines, clock lines, shift command lines, etc. For example jumpering two buses together as shown in the figure will provide a continuous 50 tie point bus for any purpose.
3. Power is connected to the circuit through the banana plug connectors on the top of the circuit. The values and polarities are noted.
4. Components such as potentiometers, other switches, etc. can have short lengths of solid wire soldered to their terminals in order to plug into tie-points in the circuit. Several switches, buttons and BNC connections are provided around the periphery of the board, which can be connected into the circuit as desired.
5. Transistors, FET's etc. can be installed straddling the center slot or be placed in line. Resistors, capacitors and diodes can be inserted by dressing their leads with long nosed pliers to fit spacing between desired insertion points.
6. When inserting DIP circuits, be sure all leads are straight and line up with the tie-point holes; then apply uniform force over the entire package until it is firmly seated. Leads should straddle the center slot. Leave open a row of tie points adjacent to the DIP leads to permit insertion of a test probe. The remaining tie-points are used for input/output connection to the DIP leads.
7. Ideally, DIP's should be pulled straight out, using a DIP removal tool — you can also lift alternate ends in small steps with a small screwdriver. Using your fingers to pull on the IC will almost invariably damage the leads and, perhaps, your fingers.
8. To avoid false triggering and unwanted oscillations, use 0.1  $\mu$ farad bypass capacitors across the power pins of all IC's. Keep components as close as possible and avoid using long jumpers for hook-up.
9. Note the ground points on either side of the box. A ground bus is defined by jumpering to one of these points.
10. Eight (8) logic indicator lights are provided. When connected to a point in the circuit, the LED will light when a high logic level is present.
11. The BNC connections allow signals to be inserted by external generators and to be observed with the oscilloscope.
12. The data switches S1 and S2 are double throw switches that connect the terminal on the switch side to a logic high (+5 V) and the terminal on the other side to logic low (gnd).
13. The logic switches S3 and S4 are buttons that provide a bounceless transition between high and low logic levels as indicated on the face. The connection is maintained as long as the switch is depressed. When the switch is released the transition is reversed.